Route to:

Return to:

INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

CHICAGO 16, ILLINOIS

GAS ABSTRACTS

JUNE, 1951

VOLUME 7, NUMBER 6

AFFILIATED WITH

ILLINOIS INSTITUTE OF TECHNOLOGY

CONTENTS

1. Gas Industry 89
2. Appliances 89
3. Combustion and Industrial Furnaces 90
4. Carbonization and Gasification 91
5. Natural Gas and Natural Gas Condensates 93
6. Petroleum and Synthetic Liquid Fuels 95
7. Analytical Methods and Tests 98
8. General and Physical Chemistry 99
9. Organic Chemistry 100
10. Chemical Engineering 101
11. Process Equipment and Instrumentation 103
12. Materials of Construction 104

GAS ABSTRACTS is published and distributed monthly by the Institute of Gas Technology, Chicago 16, Illinois. The contents of selected papers and patents are reviewed impartially by the editorial staff and material of potential interest to the Gas Industry is presented. Subscription rates to non-members of the Institute: $15.00 per year.—Printed in the U.S.A.

Copyright 1951 by the Institute of Gas Technology.

A special microfilm edition of Gas Abstracts can be supplied by University Microfilms, 313 N. First St., Ann Arbor, Michigan.

1. GAS INDUSTRY

Exploration

Lahee, F. H. EXPLORATORY DRILLING IN 1950. *Oil Gas J.* 49, 108-117, (1951) April 26.

During 1950, 10,306 exploratory wells were drilled of which 1583 were oil producers, 299 were gas producers and 132 were condensate producers. Statistics are compared with previous data back to 1938.

C. H. Riesz

Heat Pump

Sandfort, J. F. THE HEAT PUMP . . . ANSWER TO TOMORROW'S HEATING NEEDS? *Gas* 27, 50, 52, 54 (1951) March.

The advantages of the heat pump as a new source of year-round air conditioning are discussed from both the present and future economics of heating only by energy release. Most applications to date have used the vapor compression cycle and electric power, but it is pointed out that gas cycles can become more advantageous and that gas-driven engines or turbines could easily supplant the present electric motor as the driving force.

D. L. Nicol

Nationalized Gas

THE NATIONALIZED GAS INDUSTRY. *Coke & Gas* (British) 13, 118-124 (1951) April.

The article is a review of the First Report of the Gas Council and the Area Boards for the year ending March 31, 1950, on the nationalized British gas industry. The surplus for the whole industry was about $13,000, from $535 million return from gas sales. Four of the twelve Area Boards showed an aggregate loss of $5,750,000. Total (book) value of the industry on March 31, 1950 stands at $1,580 million. Detailed discussion is given upon industrial relations, efficiency, coke-oven gas, coke-oven ownership, coke marketing, research and area technical developments.

O. P. Brysch

Price Control

GAS CONTROLS. *Oil Gas J.* 49, 129 (1951) April 19.

Natural gas, petroleum gas, casinghead gas and refining gas have been placed under price control by OPS through an amendment to CPR-17. A new section, 23 a, was added which provides for the same pricing formulas as for other petroleum products, but with additional provisions relating to contracts. Long term contracts are not to be disturbed. Specific provisions are stated.

J. D. Parent

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Kornfeld, J. A. GAS STORAGE GROWTH. p. 95

2. APPLIANCES

Burners

Clarkson, A. (one-half assigned to Vapor Heating Corp.) GAS BURNER ASSEMBLY. U.S. 2,549,427 (1951) April 17.

A large refractory ring-burner is proposed, whose products of combustion pass downward to a boiler-tube chamber and return upward through an annular slot, which is surrounded by an air-chamber. The air is preheated in this chamber before entering through a top central port into the combustion zone, where it causes a toroidal movement of the flame and combustion gases.

O. P. Brysch

Marsh, H. H. and Short, G. G. GAS BURNER WITH GAS PREHEATING CHAMBER AND FLAME NOZZLES. U.S. 2,547,276 (1951) April 3.

A burner is described that makes use of heat from the flame front to preheat the unburnt gas in the gas manifold. A second characteristic is that the burner is made up of a plurality of single-port tubes, each with individual fixed primary-air openings. A third characteristic is the design of the gas port to main and air-pilot flames surrounding the main port of flame.

D. L. Nicol

3. COMBUSTION AND INDUSTRIAL FURNACES

Air Pollution

Cosby, W. T. CHIMNEY EMISSIONS FROM COAL-BURNING APPLIANCES. *Coke & Gas* (British) 13, 139-144 (1951) April.

This is Part One of a discussion of atmospheric pollution and of new information from recent BCURA researches on combustion of volatile matter from coal. The forms of pollution are classified for convenience as (a) fume, (b) grit, (c) smoke and (d) sulfur. *Fume* comprises the ultramicroscopic solid particles of 10^{-6} cm which form a very stable aerosol. *Grit* consists of irregular or spherical particles of partly carbonized coal and mineral matter from a few to 2000 microns in diameter. This major pollutant includes coal cenospheres and fused spherical ash particles, in proportions depending on combustion efficiency. Cyclones generally remove such material above 150 microns. *Smoke* consists of particles of condensed liquid volatile matter and solid carbon, and may amount to as high as 30% of the combustible in the fuel. Photomicrographs of typical particles of these pollutants are given.

O. P. Brysch

Catalyzed Incineration

Moses, D. V. and Green, R. V. CATALYST HELPS BURN WASTE. *Chem. Inds. Week* 68, 30-31 (1951) April 28.

Organic vapor wastes are almost completely converted to carbon dioxide and water by this process of vapor-phase combustion in the presence of metallic oxide catalysts at 250-275°C. The low cost of operating a catalytic oxidation plant coupled with its convenience makes this process more practicable in many cases than the conventional incineration and biological treatment methods. Low concentrations of sulfur compounds can be tolerated when copper chromite catalyst is used above 300°C. A further application of this method to include a liquid-phase process is still under study.

C. E. Hummel

Overfire Air

Gumz, W. OVERFIRE AIR JETS IN EUROPEAN PRACTICE. *Combustion* 22, 39-48 (1951) April.

It is now generally accepted that overfire air, correctly applied, is the most effective, simple and inexpensive means of improving combustion in a stoker-fired furnace. This article presents a survey of the large amount of foreign literature pertaining to this subject. Included are a historical review; discussions of design principles, nozzle arrangements, and amount of air required; and a review of practical results. Sixty-eight references, mostly from German sources, are given.

W. E. Ball

Radiant Heating Furnaces

Hess, F. O. (assigned to Selas Corp. of America) BILLET HEATING. U.S. 2,547,755 (1951) April 3.

A furnace is described for the heating of metal billets to temperatures within the range 1800°F to 2300°F. Previous practice in furnace design for continuous heating was either rotary-hearth or gravity-fed heating chamber. These two methods required heating times of five to eight hours and gave an average scale loss of five percent. The furnace described here, by use of gas-fired radiant burners decreases the heating time to one hour and the scale loss to not more than one percent. In addition, the decreased heating time improves the metallurgical and mechanical qualities of the finished product.

D. L. Nicol

LeMay, R. C. RADIANT GAS HEAT IMPROVES TECHNICS OF GLASS MANUFACTURE. *Am. Gas J.* 174, 23-26, 42, 43 (1951) April.

The arrangement of radiant gas heat in patterns without flame impingement, its rapid heat transfer, and immediate partial release within the ware itself present industry with a production tool whose usefulness has been discovered only recently. Particularly in the case of annealing of glass vessels of varying thickness the need for a method of variation of heat transfer to different parts to prevent stress is met by radiant gas heat. One of the more important points in determining heat transfer by radiant heat is the relative transmission of the wavelength band of infrared rays for different glasses.

D. L. Nicol

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Linnett, J. W. and Hoare, M. F. BURNING VELOCITY DETERMINATION. PART III. BURNING VELOCITY OF ETHYLENE + AIR + CARBON DIOXIDE MIXTURES. p. 98

McEwan, W. S. and Skolnik, S. AN ANALOG COMPUTER FOR FLAME GAS COMPOSITION. p. 98

Penner, S. S. A TWO-PATH METHOD FOR MEASURING FLAME TEMPERATURES AND CONCENTRATIONS IN LOW PRESSURE COMBUSTION CHAMBERS. p. 98

4. CARBONIZATION AND GASIFICATION

Active Carbon

Donegan, J. W. (assigned to Allied Chemical & Dye Corp.) MANUFACTURE OF ACTIVATED CARBON. U.S. 2,549,298 (1951) April 17.

Activated carbon is made from coal tar pitch by first extracting with an aromatic solvent to remove low boiling oils. The insoluble material is oxidized in presence of air while gradually heating from 150° to 400° C, then activated with steam at 1000° C in a rotary retort.

O. P. Brysch

Howe, W. L. and Moult, A. M. REACTIVATION OF BONE CHARCOAL. *Gas J.* **266**. 109-114, 119, 120, 123, (1951) April.

The disadvantages of conventional methods of reactivating bone charcoal in indirect pipe kilns are discussed. Reactivation by direct contact with products of combustion in a Nichols-Herreshoff gas-fired kiln was shown to be more efficient than present methods. This process also permitted close control of the carbon content of the char. Predrying of the wet char with waste heat increased the thermal efficiency.

W. E. Ball

Ammonia Saturator

Otto, C. SPRAY SATURATOR CRYSTALLIZER. U.S. 2,549,848 (1951) April 24.

A goose-neck seal pipe and baffles are provided to eliminate splashing of liquid entering the crystallizer.

W. E. Ball

Coal Cleaning

Fontein, F. D. (assigned to De Directie van de Staatsmijnen, Netherlands). PROCESS FOR THE SEPARATION OF SOLID SUBSTANCES OF DIFFERENT SPECIFIC GRAVITY AND GRAIN SIZE. U.S. 2,550,340 (1951) April 24.

The invention pertains to separation of mixtures of particles of different specific gravity and grain size as in coal cleaning by suspension in a "heavy medium" composed of water and fine heavy particles. The cyclonic vortex motion of the suspended mass in a lower receiving tank is utilized to concentrate the rising suspension of finest heaviest particles at the apical outlets of superimposed downwardly-discharging conical chambers, so that larger feed particles of lower specific gravity cannot pass these outlets.

O. P. Brysch

Fontein, F. J. (assigned to De Directie van de Staatsmijnen, Netherlands). PROCESS FOR CONTROLLING THE CONCENTRATION OF SUSPENSIONS. U.S. 2,550,341 (1951) April 24.

The invention relates to the process and apparatus for separation of a suspension into two fractions of controllable concentration using cyclones. The lower apical outlets of several cones discharging the heavier fraction are arranged to discharge into a single conical receiver, where their discharge rates are opposed by the resistance of the concentrated fraction. This resistance is controlled by adjusting the rate of withdrawal from the bottom (apex) of the receiver by suitable valves.

O. P. Brysch

Griffin, J. TRENDS IN COAL CLEANING. *Coal Age* **56**, 96-102 (1951) April.

The necessity for coal cleaning has been greatly increased by mechanical loading. Although experience with the new continuous-mining machines has been limited, it appears that less refuse may be obtained than with mechanical loading. The heavy-media (sand or magnetite) processes have retained their popularity, because of their effectiveness in difficult separations. Among the newer devices for fine-coal cleaning is the cyclone. Froth flotation is being used for the production of super-clean coal for electrode coke.

W. E. Ball

Coal Properties

Berkowitz, N. and Schein, H. G. HEATS OF WETTING AND THE SPONTANEOUS IGNITION OF COAL. *Fuel* (British) **30**, 94-96 (1951) April.

Observation of the spontaneous temperature rise of coal piles indicated faster rates for dry than for wet coals. It was suggested that the heat of wetting of dry coal is sufficient to raise the temperature to a point where oxidation proceeds rapidly. Experiments showed that the temperature rises in a series of dried coals when treated with moist oxygen were higher with lignitous than with mature coals, being approximately proportional to the air-dried moisture of the latter coals. That temperature rise was due to wetting and not oxidation was indicated by the fact that the same results were obtained by substituting moist nitrogen for oxygen.

W. E. Ball

Sherlock, E. STUDIES ON SOME PROPERTIES OF ALBERTA COALS. III. REFLECTIVITY AND FINE STRUCTURE. *Fuel* (British) **30**, 75-79 (1951) April.

Theoretical considerations indicated that it is probable that reflectivity is related to density and porosity. Plotting of the total reflectivity of block samples vs. a calculated density indicated only an approximate relationship. A much closer relationship was obtained between powder reflectivity and fine porosity. From this and other work, it is concluded that coal consists of crystallites, composed of large, flat molecules arranged in layer planes with a spacing of 3.5 Angstroms. Large flat molecules of a different type, distinguished by the presence of polar groups and by greater lattice spacing, are interspersed between the layer planes.

W. E. Ball

Reforming Process

Krause, A. W. CONTINUOUS CATALYTIC GENERATOR PRODUCES SPECIAL PURPOSE FUEL GAS. *Ind. Heating* **18**, 620-626 (1951) April.

A catalytic reforming process developed by Gas Machinery Company converts natural gas, propane, butane or gasoline continuously by means of a silicon carbide tube reactor into special fuel gases. Three gases made from propane in an experimental unit at Cleveland had 520-585 Btu cu ft heating values and 0.65-0.77 specific gravities which were found suitable in making glass lamp-bulb parts. A 515 Btu, 0.65 specific gravity gas made from unleaded straight-run gasoline was also satisfactory. The success of the tests has resulted in the contracting of a unit for Three Rivers, Québec. Propane or propane-air is not suitable and, although substitution of oxygen for air is possible, this is expensive and causes difficulty when adjusting burner inputs.

C. H. Riesz

NEW PROCESSING TOOL: CATALYTIC GAS REFORMER. *Chem. Eng.* **58**, 190, 192-194 (1951) April.

The continuous catalytic gas reforming unit of Gas Machinery Co. of Cleveland is being considered as a source of synthesis gas for chemical processing. Three or more silicon carbide tubes 3 in. ID and 28 ft long are filled with catalyst and heated in a cylindrical furnace using gas or oil for fuel. Steam, air and hydrocarbon feed are fed into the top and the hot product-gas is cooled at the bottom. Natural gas, propane, butane, or straight-run gasoline have been successfully reformed. The product can be used for making ammonia or methanol, for hydrogenation, and for metal and ore reductions. Properties of the product gases can be modified by temperature, pressure, reactant ratios, and catalyst. The cost of silicon carbide tubes is less than one-third that of alloy steel and these can be used at considerably higher temperatures. Erection of units in Belgium and Quebec is planned.

C. L. Tsaros

Snow, A. F. (assigned to Westinghouse Electric Corp.) GAS-GENERATOR SYSTEM FOR PRODUCING HEAT-TREATING ENVELOPING ATMOSPHERES. U.S. 2,550,126 (1951) April 24.

The inventor claims two new methods of regulating the ratio of gas-air mixture being fed to a fixed bed catalytic cracker. One method uses the pressure in the gas delivery pipe to actuate a solenoid valve. When the delivery pressure increases, the solenoid is actuated and a lean air-gas mixture is fed to the cracker. This will burn off more carbon than is deposited and the delivery pressure will be reduced thereby breaking the contact and restor-

ing the valve to its original position. The cycle starts over again with the rich gas mixture. The second claim is similar except that the pressure drop across the catalyst chamber is the actuating device for the solenoid valve.

W. G. Bair

Sulfur Recovery

METHODS OF SULFUR RECOVERY. *Internatl. Chem. Eng. & Process Inds.* (British) **32**, 178-179 (1951) April.

In view of the present shortage of sulfur, caused largely by the reduction of U.S. exports to Europe, it was thought that there would be renewed interest in the various methods adopted in Germany to combat a similar shortage lasting over a long period. In this connection the captured German documents and microfilmed reports, as well as the well-known reports by Allied investigators, should assume a new and special significance. All this material is held by the Technical Information and Documents Unit of the D.S.I.R. for the benefit of British industry. Several enquiries have been received recently on the sulfur problem, and it was felt that an effort should be made to bring this material to the notice of industrial firms and other organizations likely to be affected by the present shortage. It was decided that this should take the form of a short bibliographical survey, making the list of references as complete as possible, but leaving the plums to be picked out by those interested in the problem. The opportunity has been taken to include in the report some references to information, obtained recently, on natural sulfur supplies outside the United States.

Author's abstract.

Underground Gasification

Masterman, C. A. UNDERGROUND GASIFICATION. THE TRIALS NEAR CHESTERFIELD DURING 1950. *Gas World* (British) **133**, 374-379 (1951) April 14.

A progress report is given of the first British large-scale underground gasification tests, which were carried out at Newman Spinney. These tests indicated that a gas satisfactory for feeding a gas turbine at the site could be produced. Much work remains to be done before commercial exploitation of the process is warranted.

W. E. Ball

A FRESH TRY AT UNDERGROUND GASIFICATION. *Chem. Eng.* **58**, 182 (1951) April.

In new underground gasification experiments at Gorgas, Alabama, the Bureau of Mines plans to utilize the electrocarbonization method pioneered by the Sinclair Coal Co. and the Missouri School of Mines. An initial potential of 2400 v. for a distance of 90 ft between electrodes produces coal gas and a hot, permeable coke bed. Air blown through the latter forms producer gas. The yield and richness of total gas will of course depend upon the relative proportions of coal gas and producer gas.

W. E. Ball

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Fowler-Williams, A. A NEW APPROACH TO COAL TAR AS A SOURCE OF CHEMICALS. p. 100

McCartney, E. R. EXTRACTION OF ACIDIC IMPURITIES AND MOISTURE FROM GASES. p. 94

Robinson, W. E. and Hubbard, A. B. STUDY OF PRE-HEATING COLORADO OIL SHALE. p. 96

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Distribution

McClure, G. M. and Jackson, L. R. SLACK IN BURIED GAS PIPE LINES. *Oil Gas J.* **49**, 86-87 (1951) March 22.

The longitudinal stresses in a buried 20-in. pipe line were measured at 17 locations. The stresses found ranged from 18,900 psi tension to 14,500 psi compression. Data were also obtained on the amount of restraint offered by various types of soil to longitudinal movement of the line. Soil restraint ranged from 50 to 1080 lb per sq ft of pipe surface. It is concluded that slack, introduced to handle temperature variations occurring before the line is buried, can help minimize longitudinal stresses. But once the line is buried, slack offers little or no benefit since the soil restraint is large enough to absorb the stresses observed in these tests. The procedure used in the tests is outlined in detail.

O. T. Bloomer

Mason, A. D. THE PLANNING AND DESIGN OF HIGH-PRESSURE MAINS. *Gas Times* (British) 67, 54, 56, 59, 60 (1951) April 6.

In the planning of a distribution structure it is essential that the design not only accommodate future expansion but that it encourage expansion. The selection of the economical size of main is an economic compromise between the capital charges on the main and the pumping costs. Pumping costs are difficult to estimate due to fluctuations of demand and continued growth. Some intermediate stage between present demands and ultimate demand should be selected as the basis for comparing costs.

B. E. Hunt

Gasoline Plants

Beeson, H. H. FINANCIAL SIGNIFICANCE OF FRACTIONAL ANALYSIS. *Oil Gas J.* 49, 172, 222, 223 (1951) April 19.

The importance of accurate wet gas analyses in the design and financing of gasoline plants is discussed.

J. D. Parent

Phillips, W. L. (assigned to Phillips Petroleum Co.) CONTROLLING HEATING VALUE. U.S. 2,547,970 (1951) April 10.

The invention relates to a method of automatically controlling the heating value of the stripped gas leaving an oil-absorption gasoline plant. Control is effected by by-passing a portion of the overhead vapors from the deethanizing column directly into the residue gas line instead of through the reflux condenser.

O. Bloomer

Gas Treatment

Foster, A. L. HIGH SULFUR GAS HANDLED EFFICIENTLY. *Petroleum Engr.* 23C, 7-10 (1951) April.

Treatment of 40 MMCF natural gas per day saturated with water vapor and having a composite H_2S content of 980 grains per CCF is described and illustrated with typical operating and product data and a flow diagram. Main items in the plant processing unit are: a Girdler MEA sweetening unit for removing total acid gases, main absorber, combined deethanizer-reabsorber, glycol dehydration unit, primary stripper column with direct-fired heater and oil reclaimer, product fractionating section including the depropanizer and debutanizer columns, and the product treating section consisting of a caustic wash and sweetening units and product drying units. Production at this plant (Gulf Waddell gasoline plant near Odessa, Texas) consists of 35,750 gal/day natural gasoline, 17,850 gal/day butane, and 34,250 gal/day propane; a total of 87,850 gal/day.

H. Hakewill

Griffin, H. T. and Hoover, J. GULF OIL'S PLANT AT EUNICE, N.M. COMPLETING 2 YEARS OF OPERATION. *Oil Gas J.* 49, 148-150, 220-222 (1951) April 19.

The Eunice plant is described and a detailed flow sheet is given. The plant is designed to handle 55 to 60 million cu.ft. of separator gas per day. The gas, which contains about 100 grains of hydrogen sulfide per 100 cu.ft., is compressed in two stages to 240 psi and sweetened to better than ¼ grain per 100 cu.ft. with monoethanolamine solution. It is then compressed to 850 psi and contacted with absorption oil chilled to less than 60°F. The lean gas is then dehydrated with bauxite. A plant feature is a propane recovery of 90% or more.

J. D. Parent

McCartney, E. R. (assigned to the Fluor Corp., Ltd.) EXTRACTION OF ACIDIC IMPURITIES AND MOISTURE FROM GASES. U.S. 2,547,278 (1951) April 3.

An improvement of the previously patented two-stage process for removal of acidic impurities and moisture from natural and refinery gases by successive treatment with amine and glycol solutions is described. The present improvement in the process relates to more efficient recovery of glycol from treated gases.

H. Hakewill

Selective Adsorption

Imhoff, D. H. (assigned to Union Oil Co.) ADSORPTION PROCESS AND APPARATUS. U.S. 2,545,850 (1951) March 20.

A continuous process for separating components of gaseous mixtures by selective adsorption and desorption utilizing a moving bed of granular activated charcoal is described. Adsorbed components are recovered by steam stripping. Application to the separation of hydrocarbon gases is emphasized. Improvements in selective

adsorption and in efficiency and economy of stripping adsorbed components from adsorbate are claimed.

H. Hakewill

Underground Storage

Howard, K. C. THE DEVELOPMENT AND OPERATION OF LPG STORAGE CAVITIES IN SALT STRATA. *J. Petroleum Technol.* **3**, (Section 1), 10, 11, (Section 2), 3 (1951) March.

The process of storing liquefied petroleum gases in reservoir salt formations has proved successful in West Texas. Though untried, the process is believed to be applicable to formations other than salt.

Author's Abstract

Kornfeld, J. A. GAS STORAGE GROWTH. *Oil Gas J.* **49**, 134-135 (1951) April 19.

The natural gas industry plans to spend a billion dollars in the next five years for additional underground storage. A number of studies are being conducted on water-filled sands of good structural characteristics.

J. D. Parent

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Happel, J. and Marsel, C. PROCESSES COMPETE IN ACETYLENE BOOM. p. 100

NEW PROCESSING TOOL: CATALYTIC GAS REFORMER. p. 92

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Canadian Production

TANKER BRINGS FIRST SHIPMENT OF ALBERTA CRUDE OIL TO SARNIA. *Natl. Petroleum News* **43**, 27 (1951) May 2.

The first tanker shipment of Alberta crude oil reached Sarnia on April 24, 1951. Oil is received at the eastern terminus of the 1126 mile Interprovincial pipe line at Superior, Wisconsin. The oil is then carried 600 miles across the length of Lake Superior and Lake Huron to Sarnia, 60 miles northeast of Detroit. A regular tanker schedule for the lake route is scheduled.

C. H. Riesz

Catalysts

Fleck, R. N. (assigned to Union Oil Co. of Calif.) CATALYST FOR HYDROCARBON CONVERSION. U.S. 2,547,380 (1951) April 3.

Use of metallic phosphomolybdate catalysts for effecting hydroforming is disclosed. Methods for preparing cobalt phosphomolybdate catalysts are particularly described and claimed.

C. H. Riesz

Hockberger, W. G. (assigned to Standard Oil Co.) HYDROCARBON SYNTHESIS. U.S. 2,545,954 (1951) March 20.

The gasoline produced by catalytic hydrogenation of carbon monoxide is upgraded by passage over a bauxite catalyst under specified conditions. Alpha olefins are isomerized into other forms which have improved octane number.

C. H. Riesz

Houtman, J. P. W., Engel, W. F., Hoog, H. and van't Spijker, P. (assigned to Shell Development Co.) GROUP VIII SILICATE CATALYST ON NONSILICEOUS SUPPORT. U.S. 2,548,159 (1951) April 10.

Catalysts suitable for the hydrogenation of carbon monoxide are prepared by precipitating the silicate of a Group VIII metal (0.5-60% of total metal present) along with metal, the total amount of metal being 10-60% of the finished catalyst the remainder being a silica-free relatively inert support. Group VIII metals specifically claimed are nickel and cobalt. The support material may be alpha alumina, beta alumina, powdered aluminum, magnesia or magnesium silicate.

C. H. Riesz

Latta, J. E. (assigned to Stanolind Oil and Gas Co.) METHOD OF FORMING HIGHLY ACTIVE CATALYTIC SURFACES. U.S. 2,548,801 (1951) April 10.

The walls of a reaction vessel used for fluidizing a synthesis catalyst are coated with active catalyst. The film, 0.01-0.06 inches in thickness, is deposited from a mixture of catalyst and heavy hydrocarbon synthesis oil and is reduced to produce an active catalyst coating which is retained during synthesis of hydrocarbons from carbon monoxide and hydrogen.

C. H. Riesz

Ray, G. C. (assigned to Phillips Petroleum Co.) REMOVAL OF ACETYLENE FROM HY-

DROCARBON MIXTURES. U.S. 2,548,619 (1951) April 10.

Removal of acetylene from hydrocarbon mixtures by selective oxidation in the presence of a catalyst is described. Oxygen is added to the hydrocarbon mixture in about 5% excess of that required for complete combustion of the acetylene. This mixture is heated to 300° to 500°C and passed over a suitable catalyst at space velocities of from 200 to 1500 SCFH per CF of catalyst, at pressures slightly above atmospheric. Suitable catalysts include difficultly reducible metal oxides, such as activated alumina, bauxite, silica gel, and the oxides of magnesium, barium, and calcium.

J. J. Guyer

Cracking Catalysts

Bergstrom, E. V. (assigned to Socony-Vacuum Oil Co., Inc.) METHOD AND APPARATUS FOR HYDROCARBON CONVERSION. U.S. 2,546,625 (1951) March 27.

This patent features a method for maintaining a uniform rate of flow of catalyst through the reaction chamber of a catalytic hydrocarbon cracking unit. The unit and its operation are described.

C. A. Berg

Bond, G. R., Jr. (assigned to Houdry Process Corp.) HYDROCARBON CONVERSION PROCESS WITH THE USE OF A GRAINY SILICA-ALUMINA TYPE CATALYST. U.S. 2,548,860 (1951) April 17.

Silica-alumina cracking catalysts are prepared as a grainy precipitate, this condition being achieved through use of concentrated solutions, e.g. above 150 grams of catalyst per liter of total reaction mass.

C. H. Riesz

Kirkbride, C. G. (assigned to Houdry Process Corp.) PROCESS FOR THE CONVERSION OF HYDROCARBONS IN THE PRESENCE OF A SOLID PARTICULATE CONTACT MATERIAL, UTILIZING A MOLTEN METAL AS THE CONVEYING MEDIUM. U.S. 2,547,015 (1951) April 3.

A contact material such as silica-alumina cracking catalyst or coke is moved in particulate form through a reaction zone where cracking of hydrocarbon oils occurs. The movement of contact material is effected through use of the buoyant force and kinetic energy of columns of molten metal, such as lead.

C. H. Riesz

Oberfell, G. G. and Cade, G. N. (assigned to Phillips Petroleum Co.) PROCESS AND APPARATUS FOR CATALYTIC CONVERSION OF HYDROCARBONS. U.S. 2,546,042 (1951) March 20.

Means for cracking a gas oil by intimate contact between a cracking catalyst and finely dispersed gas oil are described. The reaction zone is heated by heat exchange from a stream of flue gases which pass in a helical path around the gas oil thereby raising the temperature within the range 800-1050°F. The catalyst is recovered and regenerated in separate zones.

C. H. Riesz

Vance, F. P., Jr. (assigned to Phillips Petroleum Co.) FLUIDIZED BED REACTOR. U.S 2,546,570 (1951) March 27.

The depth of a fluidized catalyst bed is maintained constant by maintaining two bed densities within the same bed. Variation in the height of the inlet-gas point to the less dense phase permits use of different gas rates. Adjustment of bed densities also permits variation in gas rates.

C. H. Riesz

Oil Shales

Robinson, W. E. and Hubbard, A. B. STUDY OF PREHEATING COLORADO OIL SHALE. *U.S. Bureau of Mines Report of Investigations* 4787 (1951) April.

A laboratory study of the retorting of Colorado oil shale indicated that drying and preheating in non-oxidizing atmospheres has no effect upon the oil yield. Extended or high-temperature preheating and high oxygen content of the heating gases will decrease oil yields.

C. H. Riesz

Reservoir Research

Rapoport, L. A. and Leas, W. J. RELATIVE PERMEABILITY TO LIQUID IN LIQUID-GAS SYSTEMS. T.P. 3021. *Petroleum Trans. AIME* **192**, 90-98 (1951); *J. Petroleum Technol.* **3** (1951) March.

For the conditions of flow prevailing throughout most of a gas-drive reservoir, the oil and gas can reasonably be supposed to be in capillary equilibrium with each other. Under these

conditions, and these conditions only, the relative permeability to liquid can be expressed as a function of saturation. The relative permeability to liquid in that case is dependent upon the distribution of fluids which itself is shown to be related to the capillary pressure, and, in turn, to the saturation. As a consequence, relative permeability to liquid can be expressed in terms of the volume and surface area of a network of liquid channels bounded by the rock and the gas phase. While the volume of this network can be evaluated accurately, the surface area cannot. However, for any such volume, maximum and minimum values of the corresponding surface area can be calculated from capillary pressure data. It is then possible to establish for any saturation the limits within which the value of the relative permeability to liquid must lie. As a consequence of the theoretical development, the validity of an experimental method for measuring relative permeability to liquid which utilizes a stationary gas phase is demonstrated. In this method capillary barriers are cemented to the ends of the core sample to permit the maintenance of capillary equilibrium between the two phases. At the same time, this procedure eliminates undesirable secondary phenomena such as end effects, fissure effects, etc., the presence of which adversely affect the results of other laboratory methods. The results obtained by theoretical calculations, and experimentally, are discussed. In view of the overall precision that can presently be obtained in reservoir calculations, the agreement between the calculated and measured relative permeability to liquid data can be considered satisfactory.

Authors' abstract

Synthetic Fuels

Millendorf, A. J., Naragon, E. A. and Vergilio, J. H. (assigned to The Texas Co.) COMBINATION SYNTHESIS OF HYDROCARBONS AND ORGANIC CARBONYL COMPOUNDS. U.S. 2,549,111 (1951) April 17.

The gaseous effluent from the catalytic synthesis of liquid hydrocarbons from carbon monoxide and hydrogen is utilized as the major portion of the feed to a second conversion zone where carbonylation of olefins is effected.

C. H. Riesz

Tsutsumi, S. THE SYNTHESIS OF HYDROCARBONS. (Report of the Imperial Fuel Research Institute of Japan, July 25, 1935, revised and edited by R. C. Grass). *U.S. Bureau of Mines Information Circular* 7594 (1951) April.

Some 75 experiments conducted prior to July 25, 1935, are reported in this revised, edited translation of a report of the Imperial Fuel Research Institute of Japan. Results obtained in synthesizing hydrocarbons from carbon monoxide and hydrogen are evaluated with respect to various catalysts. Nickel-manganese, nickel-uranium oxide, cobalt-copper, cobalt-nickel-copper catalysts were promoted with various oxides. The effect of carriers and of metal concentrations were studied as well as operating variables.

C. H. Riesz

Synthesis Gas

Layng, E. T. (assigned to M. W. Kellogg Co.) CATALYTIC REFORMING OF HYDROCARBONS IN THE PRESENCE OF HYDROGEN. U.S. 2,547,221 (1951) April 3.

In catalytic hydroforming of petroleum fractions, the activity of the molybdenum oxide or chromium oxide catalyst is enhanced by reduction with hydrogen-containing gases following air-regeneration and prior to use. The pressure used in the reduction is substantially below that employed in the reforming operation.

C. H. Riesz

Lynch, C. S. (assigned to Standard Oil Development Co.). PRODUCTION OF INDUSTRIAL GAS. U.S. 2,548,486 (1951) April 10.

Methane is reacted at 1500-1700°F with zinc oxide to produce a gas containing carbon monoxide and hydrogen. The zinc is oxidized to zinc oxide in a separate step. Novelty is claimed for the use of an oxide mixture comprising 85-95% zinc oxide and 15-5% iron oxide, the latter providing a high conversion efficiency and minimizing zinc vaporization.

C. H. Riesz

Maxted, E. B. CATALYSIS AND THE POISONING OF CATALYSTS. *Chem. & Ind.* 1951, 242-246 (March 31).

The bonding and the suppression of bonding in catalytic hydrogenation on metals is reviewed, mainly on the basis of the work of Maxsted and

coworkers. Strong chemisorptive bonds to metallic catalysts formed from eighth-group transition elements are possible in three ways. (1) Molecules containing non-metallic elements of Groups V-b and VI-b are toxic; the most widely known of these is sulfur and methods for its detoxication which have been demonstrated are described. (2) Metallic ions and metallic compounds are toxic only if all five orbitals of the d-shell are occupied. (3) Substances containing double bonds poison hydrogenation catalysts; the mode of attachment to the catalyst is less precisely known than some of the other types. Adaption of detoxication procedures to industrial use involves difficulties which future developments may overcome.

C. H. Riesz

Mayland, B. J. (assigned to Phillips Petroleum Co.) SYNTHESIS GAS PREPARATION. U.S. 2,546,606 (1951) March 27.

Natural gas and air are burned in an upper zone of a pebble bed. The hot pebbles at 2500-3000°F are used to crack a portion of natural gas into carbon and hydrogen. The hydrogen is burned along with the natural gas to supply additional heat. The pebbles containing carbon and now at 1700-2300°F are reacted with steam and natural gas to form synthesis gas with a hydrogen-to-carbon monoxide ratio of 2-to-1. The pebbles from this zone are recycled to the upper heating zone.

C. H. Riesz

7. ANALYTICAL METHODS AND TESTS

Coal Ash

Belugou, P. and Conjeaud, P. THE DETERMINATION OF THE ASH CONTENT OF COALS BY MEANS OF X-RAYS. INTERNATIONAL CONFERENCE ON COAL PREPARATION, Paris, 1950. Second Section (B). *Revue de l'Industrie Minerale* (French) Special Issue No. 2, 155-170, 188 (1950) December.

The absorption method of x-ray analysis is examined in detail. The authors conclude that under favorable conditions, an analysis accurate to 0.5% may be obtained in a few seconds. A standard x-ray generator provides the source, and detection is accomplished with an ionization chamber. The coal sample, after reduction to suitable size, is packed into a bakelite box, water is admitted into spaces around the coal, and the x-ray absorption is compared with a standard sample. The chemical composition of the ash must however remain constant.

I. Ladany

Flame Research

Linnett, J. W. and Hoare, M. F. BURNING VELOCITY DETERMINATION. PART III. BURNING VELOCITIES OF ETHYLENE + AIR + CARBON DIOXIDE MIXTURES. *Trans. Faraday Soc.* (British) **47**, 179-183 (1951) February.

The burning velocities of ethylene + air +carbon dioxide flames have been obtained by the shadow photograph of a Bunsen cone. The results are considered in relation to the mechanism of flame propagation, together with the corrected results for ethylene + air and ethylene + air + nitrogen presented in parts I and II.

D. L. Nicol

McEwan, W. S. and Skolnik, S. AN ANALOG COMPUTER FOR FLAME GAS COMPOSITION, *Rev. Sci. Instruments* **22**, 125-132 (1951) March.

An analog computor has been developed which simulates electrically the conditions of temperature, pressure and composition of combustion products. The quantities are represented by simple Wheatstone bridge circuits. The method can cover the calculation of the equilibrium concentration products up to ten components with an accuracy of ± 0.005 mole fraction as compared to the more precise method employing IBM equipment.

D. L. Nicol

Penner, S. S. A TWO-PATH METHOD FOR MEASURING FLAME TEMPERATURES AND CONCENTRATIONS IN LOW PRESSURE COMBUSTION CHAMBERS. *J. Chem. Phys.* **19**, 272-280 (1951) March.

The article gives the theory of the two-path method of flame temperature measurement as it applies to instruments of infinite resolving power and then extends the theory to instruments of limited resolving power such as are met with in practice. The theory here is applied to the infrared region and the author limits it to an isothermal region in the flame. The experimental technique involves inserting two probes into the flame and determining

the distance between them. Then two measurements are taken, one with the one probe acting as a cool black body, the other with the probe acting as a reflecting mirror. From the intensity of emission and the distances between probes for both cases, the true temperatures of the flame may be calculated.

W. G. Bair

Infrared Absorption

Welsh, H. L., Pashler, P. E and Dunn, A. F. INFLUENCE OF FOREIGN GASES AT HIGH PRESSURES ON THE INFRARED ABSORPTION BAND OF METHANE AT 3.3 MU. *J. Chem. Phys.* 19, 340-344 (1951) March.

To CH_4 at constant pressures, various pressures —ranging from 0 to 610 atmospheres—of N_2, A and He were added. The effect of these foreign gases upon the infrared absorption band at 3.3 mu was studied and the absorption coefficients calculated. It was noted that the absorption coefficient increases linearly with an increase in pressure of a foreign gas. The authors conclude, therefore, that the foreign gas induces an absorption which is superimposed on the normal absorption of the band, and that this absorption is caused by a dipole induced in the molecules of the foreign gas by the vibrating dipoles of the absorbing gas molecules.

J. Errington

Sulfur Method

Tighe, J. J., McNulty, J. S. and Center, E. J. MODIFICATION OF LAMP METHOD FOR SULFUR IN NAPHTHALENE. *Anal. Chem.* 23, 669-670 (1951) April.

The ASTM method of determining sulfur in a naphthalene-alcohol mixture by the lamp method is modified by raising the temperature of the solution using an infra-red lamp. With samples containing small amounts of sulfur it is suggested to increase the size of the sample flask to permit combustion of larger samples. Data are presented illustrating precision and accuracy of this method.

R. D. Clevenger

Surface Area

A COMPARISON OF THE SPECIFIC SURFACE AREAS OF SOLIDS AS CALCULATED BY THE BRUNAUER-EMMETT-TELLER AND THE HUTTIG EQUATIONS. *J. Phys. & Colloid Chem.* 55, 612-613 (1951) *April.* The surface areas of eight carbon blacks, rouge, and rutile were calculated from the adsorption isotherms of four gases by the Brunauer-Emmett-Teller and Huttig equations. The area occupied per molecule in the monolayer was calculated from isotherms on anatase, whose area had been measured by the calorimetric method of Harkins and Jura. In general, the B.E.T. results were more consistent for different gases on the same solid. As the specific surface area of the solid increased, the Huttig results became more consistent, and agreed more closely with the B.E.T. results.

W. E. Ball

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Beeson, H. H. FINANCIAL SIGNIFICANCE OF FRACTIONAL ANALYSIS. p. 94

Robinson, D. Z. QUANTITATIVE ANALYSIS WITH INFRARED SPECTROPHOTOMETERS. p. 100

8. GENERAL AND PHYSICAL CHEMISTRY

Calorimetry

Werner, A. C. TWO CALORIMETERS FOR INDUSTRIAL MEASUREMENTS. *Rev. Sci. Instruments* 22, 245-247 (1951) April.

The first calorimeter is of the conventional type, designed for measurements in the range 0-150°C. It is suitable for the determination of heat capacities of solids, heats of fusion, heats of transition, and purity determinations. The second calorimeter makes use of the method of mixtures, and is used for the determination of heat capacities in the range 100-300°C. Typical data for the heat capacities of potassium nitrate and for a solution of nicotinic acid in sulfuric acid are given. W. E. Ball

Phase Equilibria

Reamer, H. H., Sage, B. H. and Lacey, W. N. PHASE EQUILIBRIA IN HYDROCARBON SYSTEMS. *Ind. Eng. Chem.* 43, 976-981 (1951) April.

The molal volume of 5 mixtures of methane and hydrogen sulfide was determined experimentally at pressures up to 10,000 psi in the tempera-

ture interval between 40 and 340°F. The compositions of the coexisting phases were established throughout the heterogeneous region at temperatures above 40°F. The effect of temperature and pressure upon the molal volume of mixtures of methane and hydrogen sulfide is similar to that found for systems composed only of paraffin hydrocarbons. A maximum two-phase pressure of slightly less than 2000 psi was encountered at a temperature of approximately 50°F.

Authors' abstract

Spectrophotometry

Robinson, D. Z. QUANTITATIVE ANALYSIS WITH INFRARED SPECTROPHOTOMETERS. *Anal. Chem.* 23, 273-277 (1951) February.

The article discusses some of the sources of error and the effect of these errors upon quantitative analyses using infrared spectrophotometers. Errors due to incorrect measurement of transmittance and of the 0 and 100% lines are discussed. It is shown that errors caused by deviations from Beer's law can be minimized by using a slit width smaller than the width of the band being studied. The law of additivity of optical density holds only if Beer's law holds for all components. Some of the advantages of double-beam instruments over single-beam instruments in quantitative work are also brought out.

J. Errington

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Berkowitz, N. and Schein, H. G. HEATS OF WETTING AND THE SPONTANEOUS IGNITION OF COAL. p. 92

Hines, E. and Alexanderson, E. L. LEAK DETECTION BY RADIOACTIVE GASES IN BURIED PIPES. p. 103

Rapoport, L. A. and Leas, W. J. RELATIVE PERMEABILITY TO LIQUID IN LIQUID-GAS SYSTEMS. p. 96

A COMPARISON OF THE SPECIFIC SURFACE AREAS OF SOLIDS AS CALCULATED BY THE BRUNAUER-EMMETT-TELLER AND THE HUTTIG EQUATIONS. p. 99

9. ORGANIC CHEMISTRY

Acetylene Processes

Happel, J. and Marsel, C. PROCESSES COMPETE IN ACETYLENE BOOM. *Chem. Inds. Week* 68, 17-26 (1951) April 28.

Various processes for producing acetylene are described, analyzed and compared. The carbide process has been used for many years with little prospect for technical improvement. Total cost is about 11.3¢/lb. Production from natural gas, particularly in the Southwest appears to provide the most promising prospect for low-cost acetylene. For 20,000,000 lb/year capacity and including 10% profit, 10% depreciation and 47% Federal taxes, the Schoch process (electrical discharge) provides acetylene from natural gas at 9.8¢/lb., the Sachse process (partial combustion with oxygen) gives 9.5¢/lb, partial combustion with air costs 8.8¢/lb while the Wulff process (regenerative thermal cracking at 2600°F) gives the lowest cost, 5.8¢/lb. The above figures are based on natural gas at 10¢/Mcf; natural gas at 15¢/M increases the costs 0.53¢/lb. The figures given include purification by the Hypersorption process; purification by solvent extraction costs considerably more. Other economic factors are also discussed as are the acetylene chemical costs at various base locations. The Wulff process would use approximately 8 MMcf of natural gas per day in producing 20 million lbs/year of acetylene.

C. H. Riesz

Robinson, S. P. (assigned to Phillips Petroleum Co.) ACETYLENE MANUFACTURE. U.S. 2,549,240 (1951) April 17.

Ethylene is dehydrogenated in the presence of a titanium dioxide-aluminum oxide catalyst at temperatures of 2000-2600°F and a contact time of 0.01 to 1.0 seconds. The ethylene is in admixture with hydrogen or with hydrogen-methane. The titanium dioxide catalyst should be calcined at 2600-3000°F for a period of from 2-12 hours as an activation treatment.

C. H. Riesz

Coal Tar Chemicals

Fowler-Williams, A. A NEW APPROACH TO COAL TAR AS A SOURCE OF CHEMICALS. *Internatl. Chem. Eng. & Process Inds.* (British) 32, 159-164 (1951) April.

The coal industry has not lost its opportunity to provide a wide range of chemicals, in spite

of the lead taken by the petroleum industry. However, larger-capacity centralized tar refining plants, similar to those of the German refining syndicates during the war, will be needed to reduce the costs of production of the intermediate tar chemicals. This will keep tar competitive with petroleum as a source of modern synthetic chemicals, and will encourage research to find new markets for both the tonnage and rare fractions. The German and English low-temperature carbonization industries are reviewed and their economic differences are indicated from the standpoint of tar products. The high-temperature carbonization industries of these countries are likewise discussed. The 10% of the tar now used in chemical industries should be augmented by the 14 to 15% of high-boiling low-priced naphthalene, creosote and anthracene oils which require research and development. The latter are discussed in some detail and application of modern techniques of fractional distillation, hydrogenation, cracking and extraction is suggested.

O. P. Brysch

10. CHEMICAL ENGINEERING

Dust Removal

Jones, W. P. A VENTURI SCRUBBER FOR CLEANING INDUSTRIAL GASES. *Heating & Ventilating* 48, 73-75 (1951) April.

In the Venturi scrubber, particle-bearing gases collide at velocities of several hundred feet per second with a curtain of liquid across the throat, atomizing the liquid. The wetted particles coalesce downstream, and are separated in a cyclone separator. This scrubber has been successful in many gas cleaning applications in blast furnaces, open hearth steel furnaces, and in recovery of sodium sulfate and sodium carbonate in the burning of black liquors. Removal of mists and fogs has also been successfully accomplished. Four mechanisms have been suggested for the operation: (1) impingement of high velocity particles on the liquid for particles greater than .25 micron, (2) collection of fine particles by Brouman diffusion for particles smaller than 0.1 micron, (3) condensation and (4) electrostatic charge. The relative importance of the various factors has not been evaluated.

C. L. Tsaros

Electrostatic Precipitation

Sykes, W. and Broomhead, F. PROBLEMS OF ELECTRICAL PRECIPITATION. *Gas J.* (British) 266, 170, 175-186 (1951) April 18.

The history, theory, design, and application of electrostatic precipitators are discussed.

W. E. Ball

Heat Transfer

Peck, R. E., Fagan, W. S. and Werlein, P. P. HEAT TRANSFER THROUGH GASES AT LOW PRESSURES. *Trans. Am. Soc. Mech. Engrs.* 73, 281-287 (1951) April.

The heat transfer between two parallel vertical plates was determined experimentally. The space between the plates was filled with a gas and the boundaries of this gas layer were enclosed by a solid heat insulator. The variation of this heat transfer with pressure, temperature difference, type of gas and thickness of the gas layer is determined. The experimental results were compared with both theoretical and empirical equations.

R. E. Peck

Leffer, F. W. (assigned to Universal Oil Products Co.) APPARATUS FOR HEATING FLUIDS TO HIGH TEMPERATURE. U.S. 2,548,030 (1951) April 10.

Apparatus for supplying auxiliary heat to fluid catalytic units which are otherwise incapable of sustaining a given reaction is described. A heat producing unit is mounted directly above a heat dissipating chamber, the two being connected by a constricted passageway which may contain a control valve. Each vessel is constructed so as to permit the free descent of a compact bed of granular heat retentive material. Near the bottom of the heat producing unit are externally fed combustion chambers, whose hot gases pass up through the compact bed and out the top of the vessel. The heated solids drop through the passageway into the heat dissipating chambers into the bottom of which are fed the reactant fluids or inert fluids which furnish auxiliary heat to the catalytic unit. The partially cooled solids descend from the heat dissipating chamber through a constricted passageway which may contain a control valve, and onto a conveyor which lifts them to the top of the heat producing unit. This recycling of solids maintains the bed levels in the two vessels. The passageway connecting the

two vessels reaches below the bed level of lower vessel. Steam or other stripping fluid which is introduced into this passageway strips entrained combustion gases from the descending hot solids as it passes up and into the heat producing unit. Temperatures of 3000°F or more may be attained. J. J. Guyer

Rectifying Columns

Chu, J. C. PRESSURE DROP CALCULATION IN BUBBLE PLATE COLUMNS. *Petroleum Engr.* 23C, 9-12, 14-16 (1951) March.

Importance of pressure drop data and the various factors contributing to pressure drop are discussed. Four methods of computation are described: (1) Rogers and Thiele, (2) Kirkbride, (3) Elds, (4) Douphine. (1) Total pressure drop = pressure drop through the chimney uptake and annular space + pressure drop through slots + static liquid heads above slots. (2) Pressure drop is a function of gas velocity through the riser and ratio of vapor and liquid densities. (3) Similar to (1) except that the first two effects are combined. (4) Calculate total pressure drop through a dry bubble cap. Determine pressure drop by a graphical correlation based on experimental data. Add static liquid head. Comparison of (1), (2), and (4) were made. Between 10 and 30 fps riser velocity the methods seem to give similar values. Beyond 30 fps Kirkbride's method gives rapidly rising results. Dauphine's method is recommended as offering the soundest approach.

C. L. Tsaros

Byron, E. S., Bowman, J. R. and Coull, J. A ROTARY THERMAL RECTIFYING COLUMN. *Ind. Eng. Chem.* 43, 1002-1010 (1951) April.

A new type thermal rectifying column is discussed. The column comprises two concentric tubes, the outer one heated and the inner one cooled and rotated at a rate sufficient to throw off liquid condensed thereon. Vapor rises in the annular space between the tubes and reflux flows down as a film inside the outer tube. Four actions of thermal rectification take place: partial vaporization of the reflux on the outer tube; blending of this vapor with the main vapor stream; partial condensation of the vapor on the inner tube; blending of this condensate with the main reflux stream. The effect of pressure on transverse diffusion, longitudinal diffusion, and absolute vaporization rate are discussed. The great advantage of thermal over contact rectification is that it can be employed to yield sharp separations at high vacuum while contact rectification cannot. The theoretical effect of net heat input on the thermal and contact components of rectification is also discussed. The former falls to a minimum at zero net input and the latter rises to a maximum. The total efficiency shows a slight maximum at adiabatic operation, with slight minima on either side, then rises to infinity. In practice, strongly nonadiabatic operation introduces difficulties. Equations of performance for the present column are also derived.

C. L. Tsaros

Reduction Methods

Brassert, H. A. and de Jahn, F. W. (assigned to H. A. Brassert & Co.) REDUCTION OF METALLIC OXIDES. U.S. 2,547,685 (1951) April 3.

A reducing gas consisting of about four parts of CO to one part of H is brought into contact with iron oxide at a temperature of 750 to 900 C. The water vapor is controlled in the range of 0.002 to 0.01 pcf, to control the carbon content of the reduced oxide. Hydrocarbons are excluded to prevent carbon deposition.

W. E. Ball

deJahn, F. W. (assigned to H. A. Brassert & Co.) REDUCTION FURNACE. U.S. 2,548,876 (1951) April 17.

Metallic oxides such as magnetite, in finely divided form, are agglomerated with water into nodules, which are calcined by direct gas flames at 1050 to 1350 C in batches in a special refractory compartment at the top of a vertical, shaft furnace. After cooling to 600 C in jacketed lower sections of this shaft, the hardened porous nodules are gravity-discharged by slide-valves into a measuring chamber. From this chamber an additional slide valve synchronized with the valves above, permits periodic gravity-charging of measured volumes of nodules into the top of the reduction compartment of the shaft furnace. The reducing gas, preferably hydrogen, is preheated to 1000 C, introduced near the bottom of the shaft through lateral gas-distributing tubes and the downward flow of the nodule charge is adjusted so that complete reduction to metal (iron) is attained.

Lower sections of the shaft consist of sealed cooling chambers, which may also be used as preheating units for the hydrogen.

O. P. Brysch

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Imhoff, D. H. ADSORPTION PROCESS AND APPARATUS. p. 94

Otto, C. SPRAY SATURATOR CRYSTALLIZER. p. 91

Vance, F. P. Jr. FLUIDIZED-BED REACTOR. p. 96

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Compressor

Anderson, J. H. (assigned to Ingersoll-Rand Co.) GAS COMPRESSOR. U.S. 2,550,515 (1951) April 24.

A gas compressor that utilizes the pressure wave that accompanies the explosion of a gas-air mixture is described. A gas-air mixture is ignited in one end of a closed cylinder and the pressure wave moving toward the opposite end compresses exhaust gas at that end. A valve arrangement delivers this high pressure gas to a storage tank and another explosion wave is started. The chamber must be constructed so that its length is ½ the wave length of the pressure wave or an odd multiple thereof to use the effect of minimum pressure at the ignition point. When the construction is correct the pressure will be a maximum at the compression end of the cylinder and a minimum at the ignition end so a new gas-air mixture can be injected and detonated to start a new cycle.

W. G. Bair

Control Valves

Holzbock, W. G. CONTROL VALVES—THEIR ACTION AND SELECTION. *Chem. Eng.* 58, 118-121 (1951) March.

Control valves are classified with respect to design as either bevelled disk type or characterized type. Characterized valves are further classified as ratio plug, throttle plug, or V-port disk. For usual applications the bevelled disk valves are the cheaper and give more satisfactory performance. The basic decision on the type of valve to use is made by comparing the process characteristics to the valve characteristics. The objective is to keep the factor of heterogeneity low. The heterogeneity factor can be expressed as the ratio of valve response to the same load change under different initial conditions. The effect of throttling range is also discussed. The author recommends the use of valve positioners for all cases where precise control is needed. The positioner can virtually eliminate the dead zone and hysteresis in a control valve.

W. G. Bair

Explosion Prevention

SAMPLING AND ANALYZING UNITS CHECK COMBUSTIBLE CONCENTRATIONS. *World Oil* 132, 248, 250 (1951) April.

Air is continuously taken from around the mechanical seals of a centrifugal pump and passed to a standard combustible-gas analyzer. If vapor concentrations exceed a certain setting then the instrument automatically shuts down the pumping station.

O. T. Bloomer

Leak Detection

Hines, E. and Alexanderson, E. L. LEAK LOCATION BY RADIOACTIVE GASES IN BURIED PIPES. *J. Applied Phys.* 22, 460-464 (1951) April.

Gases containing small amounts of radioactive tracers are used in conjunction with Geiger-Mueller counters for the detection of leaks in buried pipes. "Soft" radiation from $C^{14}O$ may be detected by sinking hose holes into the ground along the pipe line and piping the gas into the detector. "Hard" radiation from radon is detected by a variety of less elaborate methods based on the concentration gradients in the direction of the leak. Details of methods of preparing and handling the tracers and conducting tests are given.

S. Katz

12. MATERIALS OF CONSTRUCTION

Fiber Glass Uses

Smith, J. C. GLASS—ITS PLACE IN CHEMICAL PROCESSING. *Chem. Eng.* 58, 117-119 (1951) April.

The article presents a complete review of the industrial uses of glass with good descriptions of commercially available products and their limitations. Of especial interest to the gas industry would be the applications of fiber glass. It is used mainly as an insulator and as a filter for the removal of solids from gas streams. It has also been used in the petroleum industry as an emulsion breaker, particularly in the desalting of crude oils. Glass cloth has been in use for some time as a underground pipe line wrapper.

W. G. Bair

Metals

McCullough, H. M., Fontana, M. G. and Beck, F. H. FORMATION OF OXIDES ON SOME STAINLESS STEELS AT HIGH TEMPERATURES. *Ind. Heating* 18, 638, 640, 642 (1951) April.

The mechanisms of oxide formation on stainless steel surfaces (types 304, 430 and 410) were studied in the laboratory. The specimens were exposed in atmospheres containing various concentrations of oxygen and at temperatures from 1500 to 1800°F. Surface preparation was quite important. The corrosion rate was measured by a procedure of continuous weighing and the oxides were identified by electron diffraction patterns. The time required to produce an initial oxide coating is a function of the alloy composition, the atmosphere, and the temperature.

B. E. Hunt

Moore, W. B. ALUMINUM PIPE PROVES GAS LINE ADVANTAGES. *Gas* 27, 88, 90 (1951) March.

The installation of the first aluminum pipe for the underground transmission of gas is described. Material savings were effected in the laying of the pipe but the overall construction expenses resulted in a cost 29.5% greater than the cost of installing a similar line of steel. A section of aluminum pipe was installed bare to test its corrosion resistant properties.

B. E. Hunt

Zappfe, C. A. and Landgraf, F. E. EMBRITTLING EFFECT OF STEAM ON STAINLESS AT ELEVATED TEMPERATURES. *Steel* 128, 54-57, 81, 82 (1951) April 30.

The embrittlement of stainless steels in the presence of steam at high temperatures is believed to be due to hydrogen penetration. Laboratory tests are reported showing the increased embrittlement caused by the steam reaction as compared with the treatment afforded the metal specimen in an inert atmosphere.

B. E. Hunt

Corrosion

Fontana, M. G. CORROSION. *Ind. Eng. Chem.* 43, 69A, 70, 72 (1951) May.

Following a brief discussion of the basic mechanisms of the corrosive attack of underground pipe, the importance of complete corrosion prevention is stressed.

B. E. Hunt

Parker, M. E. PIPE THICKNESS AS RELATED TO PIPE LIFE. PART 7. *Oil Gas J.* 49, 106 (1951) April 5.

The question of additional pipe wall thickness as corrosion protection is discussed in view of the corrosiveness of three sample soils. The conclusion is reached that there is nothing to be gained in corrosion protection by the addition of steel to the wall thickness. The cost of the extra metal is high relative to the cost of efficient cathodic protection.

B. E. Hunt

Parker, M. E. CATHODIC PROTECTION OF TANK BOTTOMS. *Oil Gas J.* 49, 131 (1951) May 3.

The application of cathodic protection by means of either rectifier installations or magnesium anodes is described. The dangers of interrupting the electrical circuit during repairs or maintenance operations are discussed.

B. E. Hunt

SERVICE TO READERS

Bibliographies and Literature Searches

The library will prepare bibliographies and make literature searches on a cost basis plus a fixed service charge. A comprehensive statement outlining the problem in detail must be presented with the request.

Photocopies

The library will furnish photostatic or microfilm copies of articles abstracted in GAS ABSTRACTS at cost.

Abstracts on Cards

Copies of any abstract in GAS ABSTRACTS on 5 x 8 cards will be supplied on request.

Periodicals Abstracted for GAS ABSTRACTS

American Gas Association Monthly
American Gas Journal
American Petroleum Institute Quarterly
American Society for Testing Materials Bulletin
Analytica Chemica Acta
Analytical Chemistry
Bituminous Coal Research
Blast Furnace and Steel Plant
British Abstracts
British Coal Utilization Research Association Monthly Bulletin
Butane-Propane News
California Oil World
Canadian Chemistry and Process Industries
Canadian Gas Journal
Canadian Journal of Chemistry
Canadian Journal of Physics
Canadian Journal of Technology
Ceramic Age
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Engineering Progress
Chemical Industries Week
Chemical Reviews
Chemistry and Industry
Coal Age
Coal Heat
Coke and Gas
Combustion
Compressed Air
Construction Methods and Equipment
Corrosion
Electronic Engineering
Engineers' Digest
Fuel Abstracts
Fuel in Science and Practice
Fueloil and Oil Heat
Gas
Gas Age
Gas and Oil Power
Gas Heat in Industry
Gas Journal
Gas Research Board Publications
Gas Times
Gas World
Heating and Ventilating
Heating, Piping and Air Conditioning
Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Gas
Industrial Heating
Institution of Gas Engineers: Bulletins, Communications and Transactions
Instruments
Iron Age
Journal of the American Chemical Society
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Education
Journal of Chemical Physics
Journal of the Chemical Society (London)
Journal of the Institute of Fuel
Journal of the Institute of Petroleum
Journal of Metals
Journal of the Optical Society of America
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical and Colloid Chemistry
Journal of Research National Bureau of Standards
Journal of Scientific Instruments and Physics in Industry
Journal of Southern Research
LP Gas
Materials and Methods
Mechanical Engineering
Mining Engineering
National Gas Bulletin of Australia
National Petroleum News
Nature
Nucleonics
Official Gazette of the U.S. Patent Office
Oil and Gas Journal
Petroleum
Petroleum Engineer
Petroleum Processing
Petroleum Refiner
Physics Today
Pipe Line News
Power
Power Engineering
Proceedings of the Institute of Radio Engineers
Public Utilities Fortnightly
Refrigerating Engineering
Review of Scientific Instruments
Science
Southern Power and Industry
Steel
Transactions American Society of Mechanical Engineers
Transactions of the Faraday Society
U.S. Bureau of Mines Bulletins, Information Circulars Reports of Investigations and Technical Papers
World Oil